

US-PAT-NO: 6303230

DOCUMENT-IDENTIFIER: US 6303230 B1

TITLE: Laminates

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This invention relates to laminates in which a layer of polyimide precursors and a layer of photosensitive resins are formed one on top of another on an electric conductor such as a stainless steel foil and also to laminates consisting of a stainless steel foil and successive layers of polyimide precursors and photosensitive resins useful for the manufacture of HDD suspensions. In particular, the use of resins containing a repeating unit derivable from specific aromatic diamines and aromatic carboxylic acid dianhydrides as polyimide precursors makes it possible to fabricate an insulator of high fabrication accuracy and reliability on an electric conductor and, in addition, the laminates are useful as materials for the manufacture of HDD suspensions of an integrated circuit/wiring structure with high accuracy.

This invention relates to laminates which serve as materials suitable for HDD (hard disk drive) suspensions.

An HDD (hard disk drive) suspension has been prepared by etching a stainless steel foil and a thin-film magnetic head is mounted on the tip of the suspension and packaged by wire bonding with a gold wire. A general structure of such HDD suspension is described in PETEROTECH, Volume 18, Number 11, page 351.

In recent years, however, active studies directed to smaller size and higher density and capacity of HDD suspensions are under way and the indispensable theme of such studies is low rise of suspensions (sliders). From this viewpoint, the conventional gold wire is an obstacle to low rise and, in addition, its resistance to air flow is detrimental to high-speed manufacture.

Another object of this invention is to provide laminates of high reliability and fabricability useful for the preparation of HDD suspensions.

This invention also relates to laminates which consist of a stainless steel foil and layers, formed one on top of another, of polyimide precursors and photosensitive resins and are useful for the preparation of HDD suspensions and, preferably, said polyimide precursors have a main structural unit represented by the following general formula (2) ##STR1##

According to this invention, the polyimide precursors thus prepared are put in place as film in contact with a layer of photosensitive resins and it is preferable that the resin layers cure with a thermal expansion coefficient of  $5 \times 10^{-5} / \text{degree. C.}$  or less. When the thermal expansion coefficient exceeds  $5 \times 10^{-5} / \text{degree. C.}$ , particularly in applications to HDD suspensions, the circuit warps on cooling after processing by high-temperature heat treatment for imidation and such warpage tends to cause troubles in practical use.

A foil of copper, aluminum or stainless steel may be used as electric conductor. A stainless steel foil, on account of its modulus, is desirable as material for HDD suspensions. The thickness is optional, but it is desirably 200  $\mu\text{m}$  or less for reasons of manufacture and fabrication. In particular, a foil as material for the manufacture or fabrication of HDD suspension preferably has a thickness in the range from 10 to 70  $\mu\text{m}$ . When the thickness of a foil exceeds 70  $\mu\text{m}$ , low rise becomes difficult to maintain while in use as HDD suspension or the fabrication into suspensions by folding or the etching of stainless steel becomes difficult. On the other hand, a thickness of less than 10  $\mu\text{m}$  is undesirable for lack of elasticity as suspension. It is allowable to roughen the surface of a foil or form a layer of alloy or primer on the surface for improvement of adhesion.

The laminates thus obtained are exposed and developed to form a desired pattern on the photosensitive resin layer and then treated with an alkaline solution to etch the polyimide precursor layer. It is possible to apply heat during etching to increase the processing speed. Thereafter, the photosensitive resin layer is stripped and the polyimide precursor layer is cured. Though the conditions are optional, the curing is effected at 200.degree. C. or more, preferably at 250.degree. C. or more, to let polyimides fully show their characteristics. As for the method of heating, it is possible to apply batch heating in a hot-air oven or roll-to-roll heating.

In the manufacture of HDD suspensions or advantageously of HDD suspensions in which circuits are formed directly on an integrated structure of gimbals and load beam, a patterned polyimide layer is formed as insulation layer on a

stainless steel foil in the manner described above and what follows next in the fabrication into a suspension is the formation of an electric conductor on the patterned insulation layer in an optional manner. For example, a thin layer of metal such as copper and nickel is formed by sputtering on polyimides and subsequently plated electrolytically by an electric conductor such as copper.

The base board whose photosensitive resin layer alone had been patterned was **etched** in a simplified shower by a 10% aqueous solution of sodium **hydroxide** at a liquid temperature of 45.degree. C. and at a water pressure of 1.5 kg/cm.sup.2 for 35 seconds and then **etched** by warm water under the same conditions. The bare portion of the **polyimide** precursor layer was removed clean and the substrate copper foil was visually confirmed.

The base board whose photosensitive resin layer alone had been patterned was **etched** in a simplified shower by a 10% aqueous solution of sodium **hydroxide** at a liquid temperature of 15.degree. C. and at a water pressure of 1.5 kg/cm.sup.2 for 10 seconds and then **etched** by warm water of 40.degree. C. under the same conditions. The bare portion of the **polyimide** precursor layer was removed clean and the substrate stainless steel foil was visually confirmed.

Thus, wiring was formed on the stainless steel/polyimide base board as described above, and the stainless steel foil was further etched and folded to give an **HDD** suspension.

Laminates of this invention allow extremely easy fabrication of insulators of high fabrication accuracy and reliability on an electric conductor. The laminates are useful as materials for the manufacture of **HDD** suspensions of an integrated circuit/wiring structure with high accuracy.

3. A laminate suitable for the manufacture of **HDD** suspensions, said laminate comprising:

a layer of copper foil or stainless steel foil, having single a thickness of 200 .mu.m or less coextensive with and formed under said layer containing **polyimide** precursor; wherein said laminate can be used for making a copper foil or stainless steel foil with patterned **polyimide** insulator by selectively exposing said layer of photosensitive resin, developing the resultant layer containing a photosensitive resin by an acid solution, removing the exposed

layer containing a **polyimide** precursor by **etching with an alkaline** solution, using the remaining photosensitive resin as a mask, and curing the residual **polyimide** precursors.

metallic foils to either surfaces of polyamide film and patterning polyamide film from one side

PRIORITY-DATA: 1998JP-0216848 (July 31, 1998)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 2000049195 A	February 18, 2000		004	H01L021/60

INT-CL (IPC): H01 L 21/60

ABSTRACTED-PUB-NO: JP2000049195A

BASIC-ABSTRACT:

NOVELTY - Metallic foils (2,3) are bonded to either sides of polyamide film (1). Resist patterns (4,5) are bonded to both metallic foils and etching of said foils takes place. Resist pattern is removed, followed which patterning of polyamide film is performed from either upper or lower side. The metallic foil (3) patterned along with polyamide film, is then removed.

USE - For electronic components.

ADVANTAGE - The method enables patterning both polyamide film and metallic foil at the same time so that inexpensive manufacturing process is offered.

DESCRIPTION OF DRAWING - The figure shows the explanatory diagram of mask manufacture. (1) Polyamide film; (2,3) Metallic foils; (4,5) Resist patterns.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWC
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**Search Results - Record(s) 1 through 2 of 2 returned.**☒ 1. Document ID: JP 2000049195 A

L1: Entry 1 of 2

File: JPAB

Feb 18, 2000

PUB-NO: JP02000049195A

DOCUMENT-IDENTIFIER: JP 2000049195 A

TITLE: PRODUCING METHOD OF ELECTRONIC COMPONENT MEMBER

PUBN-DATE: February 18, 2000

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INT-CL (IPC): H01 L 21/60

## ABSTRACT:

PROBLEM TO BE SOLVED: To provide a producing method for a member of electronic components.

SOLUTION: Resist patterns 4, 5 are formed individually on metallic foils 2, 3 which are laminated on both sides of a polyimide film 1, and both of the metallic foils 2, 3 are simultaneously etched in an etching liquid, and then the resist patterns 4, 5 are exfoliated. After that, the polyimide film 1 is patterned by plasma etching with the use of only the metallic foil 3 as a mask, and then the metallic foil 3 which has been used as a mask is eliminated. As a result, as a member for electronic components, a laminated body 8 can be obtained, which consists of the patterned polyimide film 1 and the patterned metallic foil 2. Because of only once requirement for plate making, it is possible to produce the member for electronic components at lower costs, and it is also possible to obtain the high quality member which is laminated by the polyimide film pattern and the metallic foil pattern at their high positional precision.

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Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWC
Drawn Desc	Image										

☒ 2. Document ID: JP 2000049195 A

L1: Entry 2 of 2

File: DWPI

Feb 18, 2000

DERWENT-ACC-NO: 2000-229921

DERWENT-WEEK: 200020

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TITLE: Mask manufacturing method for electronic components, involves bonding

	Type	L #	Hits	Search Text	DBs	Time Stamp	C o m m e n t s	E r r o r s	E r r o r s
1	BRS	L1	358	etch\$3 same polyimide same (alkaline or alkylamine or amine)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/05/14 17:25			0
2	BRS	L8	53	(etch\$3 with wet) same polyimide same (alkaline or alkylamine or amine)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/05/14 17:22			0
3	BRS	L15	5	"wireless suspension" and 8	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/05/14 17:26			0
4	BRS	L22	707	etch\$3 same polyimide same (alkaline or alkylamine or amine or NaOH or hydroxide)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/05/14 17:26			0
5	BRS	L29	13	("wireless suspension" or "hard disc drive" or "HDD") and 22	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/05/14 17:27			0